

# **WHITE PAPER**

## ***Resurrecting Early Christian Lives: Digging in Papyri in A Digital Age***

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## 1. Introduction to the project

Our project was inspired by the success of our cross-disciplinary and transnational team in building, launching, and running Phase One of the web-based crowd-sourced project Ancient Lives in 2011 – 2013 ([ancientlives.org](http://ancientlives.org)). A quarter million volunteer participants from around the globe have transcribed ancient Greek papyri manuscripts from Egypt since the website was put on line by the Citizen Science consortium Zooniverse in July 2011 ([zooniverse.org](http://zooniverse.org)). Our group of collaborators, drawn from several countries and representing diverse fields of research (papyrology; bioinformatics; computational science; crowd-sourcing theory and practice; Greek and Coptic language; late Roman and Byzantine history; and early Christian literary studies), proposed to extend the project into a new phase. (For a complete list of our collaborators please see Appendix 1 below).

Our most basic goals for Phase Two of Ancient Lives have been threefold. *First*, to advance the comparative study of fragmentary texts in Greek and other relevant languages preserved on ancient papyri, both published and unpublished. We started with those found at the turn of the twentieth century in trash heaps outside the Roman-period Egyptian city of Oxyrhynchus by an archaeological team from Queen's College, Oxford. The work of those scholars, Bernard Grenfell and Arthur Hunt, was sponsored by the Egyptian Exploration Fund (now Society), which still retains tight control over access to the papyri brought back to England in the period 1896 – 1906. Our team had a special interest in locating markers of Christian identity and practice in documentary sources, while planning to expand our reach to include texts in Coptic, the late form of the Egyptian language in broad use by the local population in the first millennium. Our *next* goal was to develop more advanced machine tools to work with digitized texts in both image and character string form, to help make computer automated reading of handwritten scripts more efficient and accurate for a variety of potential applications beyond our own datasets, including character recognition leading to identification of individual scribal hands. And our *third* goal, which was no less important in our estimation, was to train graduate students, undergraduates, and citizen science volunteers in the basic techniques of papyrology and digital database management.

The work progressed as follows. Through the Zooniverse platform we uploaded digitized images of manuscript fragments from a cache of ca. 300,000 items from the Oxyrhynchus Papyri collection, which is owned by the Egypt Exploration Society ([www.ees.ac.uk/papyri](http://www.ees.ac.uk/papyri)) and housed at the Sackler Library at Oxford University ([papyrology.ox.ac.uk/POxy/](http://papyrology.ox.ac.uk/POxy/)). These images were provided through the offices of Dirk Obbink, who was PI on the UK (AHRC) grant that ran parallel to our NEH-funded work (2014 – 2016), and his research associate James Brusuelas. Our University of Minnesota team had worked closely with both of these scholars during Phase One of the Ancient Lives project, funded largely by a Minnesota Futures grant, during which time co-PIs Lucy Fortson (School of Physics and Astronomy, and a founding member of Zooniverse) and Nita Krevans (Classical and Near Eastern Studies) played the leading roles for our Minnesota team.

When our site went live again in 2014, users could access the material through the Zooniverse platform for citizen science volunteers. They would be presented with digitized images of individual *Oxyrhynchus papyri* at random and asked to transcribe the Greek (and now Coptic) characters as best they could read them from the papyrus photographs. Our users used a point and click system for matching the characters on the papyrus image with an on-screen keyboard displaying those ancient scripts that we provided along with the images. User data were collected, stored, and analyzed for the patterns of clicks and identifications, with exact placement of each click recorded on an x/y axis, and then consensus transcriptions were produced. At first we employed a kernel density linear algorithm already developed for Phase One, based on the techniques employed to sequence the human genome, and then a more efficient agglomeration algorithmic analysis that we developed for this purpose. The records of user choices provided rich data for the work of our computational scientists, led by consultant John Wallin, also a member of the Zooniverse network, and his graduate student Alex Williams.

Our co-PI Anne-Françoise Lamblin, director of informatics research at the Minnesota Supercomputer Institute, had developed the kernel density algorithm for Phase One, drawing on her experience on team sequencing the human genome. For Phase Two, Lamblin, along with her associate Trevor Wennblom, developed a new screen-based curatorial tool ('Dieforos') for editing fragmentary texts and providing metadata for the consensus transcriptions, shown alongside the digitized images. This tool and our consensus algorithms are available on an open-source basis and are adaptable to a variety of alphabetic scripts beyond Greek and Coptic.

Our research proposal also mentioned our plan to create an on-screen, user-friendly Coptic keyboard for our volunteer transcribers to use when offered images of papyri in that language. Development of this keyboard was by joint agreement to be the responsibility of our UK partners at the *Oxyrhynchus Papyri* Project and the Faculty of Classics at Oxford, but ultimately was created by our Minnesota team (see below).

Members of the research team at Minnesota who were devoted to our first goal described above, advancing the study of Greek and Coptic texts, were headed by project PI Melissa Harl Sellew and co-PI Nita Krevans, along with postdoctoral fellows Geoffrey Smith and Isabelle Marthot-Santaniello. Using the Dieforos curatorial tool developed as part of Phase Two, they and a total of fifteen of their students studied the consensus reconstructions to locate meaningful data related to our interest in both the general literary and social-historical Roman world of the first centuries of our era (ca. 100 – 600 CE) and more specifically the character of early Christianity in Egypt.

Our results range in our judgment from good to excellent in reaching our three overall goals. In what follows we summarize the scope and development of our research; our patterns of collaboration; the challenges we faced in pursuing our goals, and how we worked to meet those challenges; and potential applications and lessons we can offer the larger scholarly community from our experiences.

## 2. Scope and development of our research

Throughout the period funded by the grant and its two no-cost extensions, our team worked toward all three of the goals mentioned above in tandem; here are some signposts of how the work went forward.

During this phase of our work funded by the NEH (March 2014 - March 2016), the Ancient lives website hosted approximately 132,000 new and unique users, who examined more than 12,000 separate fragments and applied nearly 2,800,000 individual clicks as recorded in our database. These numbers are in addition to the 275,640 unique volunteer transcribers in the initial rollout of the site (July 2011-May 2013), who examined 27,564 fragments while recording 7,867,922 clicks on alphabetic characters and 201,784 measurements of margins and spacing between columns. The numbers from the two phases amounted to more than 400,000 unique individuals who contributed to the crowd-sourcing of transcribing papyrus fragments, applying approximately 11,000,000 clicks on individual characters, which enabled the production of legible texts of nearly 40,000 individual fragments.

These data were fed into our transcription pipeline, initially via a linear kernel density algorithm developed by our team of computational scientists and informatics experts on the analogy of the successful string analysis deployed in sequencing the human genome. This work was led by co-PI Anne-Françoise Lamblin, an expert in bioinformatics at the Minnesota Supercomputer Institute, and consultant John Wallin, director of Computational Science at Middle Tennessee State University (see details of their publications in Appendix 2 below). Sequences of Greek alphabetic characters were treated as though genetic markers in human DNA.

When this process was deemed sufficiently accurate but too slow and thus too expensive (taking more than 24 hours of computer time to run each data set), Wallin developed a new tool based on agglomerative analysis, which discounts outliers among sets of user clicks and weighs more heavily the tighter clusters of clicks to achieve a more efficient pipeline to convert the most meaningful clicks into usable data. What used to take more than a full day of computer time to achieve can now be accomplished in less than ten minutes, with commensurate savings in costs. The new system also avoided a difficulty in applying the earlier linear model, which clarified the often sloping character of the ancient scribes' lines of script, which tend to float slightly downward as they move from left to right.

The challenge, then, was how to make this mass of material accessible to scholars of ancient Greek texts and related topics. Lamblin and Trevor Wennblom (her associate at the Minnesota Supercomputer Institute) developed an on-screen interface named Dieforos for editing and curating the strings of Greek characters generated by the kernel density algorithm from the aggregate of user click data. This tool (made available to the scientific community through the Github Repository) presents the character strings in a legible text that can then be analyzed for purposes of identification and commentary. An important innovation was that

Dieforos works directly on the user's computer screen, obviating the need for editors and commentators to work on the text off-line and then import the editorial work and metadata secondarily.

The research team members located in the Department of Classical and Near Eastern Studies at the University of Minnesota, who specialize in Greek and Roman literature, papyrology, and history of religions, used the Dieforos tool to work on the basis of these incoming consensus transcriptions, beginning in spring 2014. Sometimes the fragment would represent a text that was previously known (determined via searching with the digital tools available through the Perseus platform and the on-line Thesaurus Linguae Graecae); sometimes the fragment would be identified as the first witness from antiquity of a text otherwise only preserved through later quotations or late medieval manuscripts far removed in time from their composition; otherwise the fragment would be marked as "unknown" and set aside for further study by our team.

Principal Investigator Melissa Harl Sellew hired and supervised postdoctoral fellow Geoffrey Smith, at that time on a temporary appointment at Texas, who during June and July 2014 pursued intensive studies of Coptic documents in Minneapolis and at the Sackler Library in Oxford. He helped identify important collections of digitized texts that we expect to utilize in the next phase of the project, such as the resources at the University of Pennsylvania curated by Prof. Robert Kraft. Smith identified several promising lines of research for the coming academic year, wrote an article about an early Christian hymn preserved on a papyrus from Oxyrhynchus, and produced final editions of early Christian papyri in Coptic and Greek for publication in the Oxyrhynchus Papyri series (see Appendix 2 below for a list of publications and selected paper presentations arising from work on this grant).

Our team faced significant delays in testing the extension of our user interface to include Coptic texts in even a preliminary fashion. The holdup was due to a failure to hire a developer dedicated to the task of rebooting the Ancient Lives website, or to supply a Coptic keyboard, both the responsibility of our UK partners at Zooniverse at Oxford under the terms of our agreement connected with this grant; when completed this reboot would allow us to implement the Coptic match/search capabilities along the lines of the existing Greek programs. (Ultimately our host site Zooniverse introduced an entirely new backend platform for web-based crowd sourcing, which though a major advance also delayed implementation of our Coptic text analysis significantly.) This lack of a Coptic interface obviously posed a major obstacle to our proceeding with our analysis of Coptic documentary sources for early Christian life in Egypt; for this reason PI Sellew turned much of her attention to other sources of Coptic manuscripts as detailed below, while the rest of team worked with crowd-sourced transcriptions of Greek texts..

While awaiting the reboot of the Ancient Lives website by our UK partners, as well as the new keyboard interface, our Minnesota post-doctoral fellow Geoff Smith filled the gap temporarily by assembling and uploading to our project's Google drive

images and transcriptions of several Coptic papyri representing the range of literary, sub-literary, and documentary hands and formats we expected to encounter. He then designed, created and uploaded a preliminary Coptic keyboard for a temporary private section of Ancient Lives for beta testing our existing transcription tools for Coptic. The Greek alphabetic script forms the basis for Coptic writing, along with six additional characters representing sounds not used in Greek. The overlap is both helpful and at times misleading. Users might easily confuse texts in one language for the other. A “sandbox” of fifty Coptic texts obtained from the open-source site Papyri.info was tested in the summer and fall of 2014 by a small group of Minnesota students and colleagues.

In our research proposal we had made mention of our intention to deploy user-generated measurements of the margins and character and line spacing of texts on papyrus in our research. This sort of information was in fact gathered during much of Phase One and the early stages of Phase Two. Our hope was that these data would be useful in finding patterns of sizing and arrangement that could be used to identify smaller scraps of fragmentary manuscripts. This would add to our knowledge of ancient book formatting aesthetics and techniques and possibly generate a set of usable spacing patterns adaptable to parallel research in other fields of manuscript studies. It turned out, however, that the measurements as actually made on screen by our users, employing the small movable ruler we provided as a tool, were too various in their quality and in the details of what was actually being measured to be useful. Presenting data about the size of margins, number of columns and lines, and similar observations is crucial when preparing a fragmentary text for final publication; but at this stage the time and effort needed on the part of our expert curators, both the faculty and our graduate students, to correct and reorient the user data was seemed too out of proportion with the utility of the results.

We made better initial progress in investigating possible algorithms for data mining across multiple databases, pursued largely in collaboration with colleagues in Classics and Papyrology at Duke University. This took place both by email and in a full-day Skype meeting of all our partners in June 2014, with contributions from Trevor Wennblom (informatics), John Wallin, Professor Josh Sosin of the Duke Digital Collaborative, which is associated with the key web resource Papyri.info, and two computing experts from the Zooniverse platform.

Involvement of students in our work, both as transcribers and as research team members, has been a high priority from the start. With monies from the grant, we hired Sellev's Ph.D. student Jessica Shao as Research Assistant on the project, beginning in February 2014. Shao spent much of July 2014 in Oxford, training in manuscript studies for one week at the Sackler Library with our UK PI Dirk Obbink; she also took a workshop on Greek paleography at Lincoln College. Shao, whose special research interest is the textual history of the Greek New Testament, was given the opportunity to study an unpublished papyrus fragment first hand at the Sackler, guided by James Brusuelas, researcher with the Oxyrhynchus Papyri Project and a colleague on this grant. This fragment turned out to be the only papyrus of the

Biblical book of *1<sup>st</sup> Timothy* to have been preserved. As a result of this work, Shao was assigned the preparation of the *1<sup>st</sup> Timothy* text for a forthcoming volume of the official *The Oxyrhynchus Papyri* series (vol. LXXXI), which has now been published by the Egypt Exploration Society ([www.ees.ac.uk/papyri](http://www.ees.ac.uk/papyri)) in December 2016.

Our outreach to students at all levels starting in middle school also involved inviting them to become citizen science volunteers on the Ancient lives website. For example, co-PI Nita Krevans made several presentations on the project to students at the University of Minnesota, starting by addressing high-achieving applicants to the College of Liberal Arts in July of 2014. She presented a workshop on writing technologies at the Consortium for the Study of the Premodern World, University of Minnesota, to an audience of graduate students and faculty members, in spring 2015. Krevans and Sellew each gave several talks during the period of the grant to high school students enrolled in the College in the Schools program or to colleagues at a variety of venues on campus. Even after the grant funding had ended, this work of outreach has continued: when Sellew visited St. Olaf College in March 2017 to give a lecture on the history of the book as material object, drawn in large part from the data from this project, she offered a 90-minute workshop on crowd-sourced web-based transcription of Greek papyri to their Classics majors.

Sellew recruited two undergraduate Classics students to work in summer 2014 and for the subsequent academic year; both were successful in obtaining grants to support their work: Alyssa Ramsden, with interests in Classics and archaeology, and Kalyssa Tatroe, with interests in Ancient Egypt, and knowledge of both Coptic and Greek. Over the summer of 2014, Geoff Smith trained these and another Minnesota student in basic papyrological methods and introduced examination of texts from Dieforos that they would follow up with that fall (some details discussed below).

Another student who worked on the project at this stage was Theresa Chresand, a major in Greek who had worked extensively on the initial phase of Ancient Lives (2011 - 2013) as a key participant in the Talk feature addressing questions from users while also contributing Blog posts on a variety of subjects. Chresand worked on this new phase for one semester, helping with our transcription work up until her graduation in May 2014 and departure for graduate school at Cambridge University in the UK, where she continued her training in papyrology.

Geoffrey Smith was a very productive contributor during his brief official time on the project (June - August 2014), and thankfully continued his associations with our work after taking up a tenure-track position as Assistant Professor of Greek, Coptic, and Religious Studies at the University of Texas at Austin. In view of his departure, we needed to hire a new postdoctoral fellow to replace Smith. We were pleased to be able to hire Isabelle Marthot-Santaniello, who was a recent Ph.D. graduate from Paris with special expertise in the Greek and Coptic documentary papyri from Upper Egypt that play such a key role in our research goals. Marthot-Santaniello joined our team in Minneapolis in September/October 2014.

Sellew, Marthot-Santaniello, and their students worked extensively throughout the academic year 2014-2015 with published and unpublished Coptic and Greek literary and documentary texts on papyrus, especially those related to early Christianity in Egypt. Marthot-Santaniello taught special courses on Greek manuscript studies and papyrological methods. From October through December of 2014 she led Ramsden and Tatroe through the analysis of 25 separate papyrus fragments in Greek produced by our pipeline with good crowd-sourced transcriptions. Marthot-Santaniello and our students monitored user activity on the Ancient lives website, answered inquiries, and updated the blog entries.

Using the Dieforos curation tool described above, Marthot-Santaniello did an initial study of 125 fragments, and then supervised the students in their scrutiny of an additional 25 promising items. This was an unmitigated success. They identified eight items as coming from previously known literature (Homer's *Iliad*, the Biblical *Book of Daniel*, and the *Sayings of the Desert Fathers*) as well as several documents of daily life. Another item identified by our students (Hippocrates, *De artiaculis* 41) is the only known papyrus text from the famous Hippocratic medical corpus.

In her own work with Dieforos Marthot-Santaniello was able to identify several intriguing unpublished documents among the Oxyrhynchus papyri, including a fascinating document detailing payments to a local butcher for providing pork (!) for the Easter feast of local Christians. She also proved that one of the texts identified by the students should be decisive in untangling the early transmission of manuscripts related to the *Sayings of the Desert Fathers* (*Apophthegmata Patrum*). As we will explain below in part 4, however, she was prevented from preparing these texts for publication by the policies of the papyri's legal owner, the Egypt Exploration Society.

Marthot-Santaniello instead prepared two articles for publication on documentary papyri from Fustat, Egypt, during her first six months in Minnesota, and continued her contributions to a digital lexicographical database for documentary papyri under the aegis of the Institut français d'archéologie orientale. She made two presentations on our project at the École Pratique des Hautes Études in Paris for seminars run by Professor Alain Delattre and Professor Jean-Luc Fournet. Marthot-Santaniello also gave a public lecture in March 2015 to the Department of Classical and Near Eastern Studies on the topic *The Treasures of the Dioscorus Archive: How a coherent group of papyri sheds new light on the literature and history of Byzantine Egypt*.

Throughout the grant period, PI Melissa Sellew worked extensively with published Coptic and Greek documentary texts on papyrus and ostraca, mostly in Minneapolis, but also on several research trips. She traveled to the Dumbarton Oaks Research Library in Washington, D.C. in March 2014, and made two stops at the Papyrus Collection of the Austrian National Library in Vienna in July and August 2014 (bracketing two weeks of unrelated research in Turkey). These visits enabled Sellew to gain further detailed expertise in key published material (Washington) and study some of the most characteristic styles of early Christian documents in person, some



of them unpublished (Vienna). On her second trip to Vienna, in August 2014, Sellew returned to Vienna to investigate the more physical aspects of the many Coptic documentary papyri housed there. The professional conservators in Vienna were exceptionally helpful in making unpublished texts available for her to study, an exceptional opportunity to examine tangible details of scribal practices - details that tend to go unnoticed when reading texts via images alone.

In May 2015, PI Sellew, co-PI Krevans, postdoc Marthot-Santaniello, and Sellew's M.A. student Alyssa Cady presented a sixty-minute overview of our project at the *North American Papyrology Seminar*, hosted by the University of Michigan in Ann Arbor. Here we also explored expanding our subject database to include the many Coptic ostraca held in the Kelsey Museum. Cady was brought onto the team starting in summer 2015 through funding via the University's Graduate Research Partnership Program. Cady presented her discovery of an unnoticed fusion of two separate fragments of Homer that had been photographed as though from one papyrus; analysis of the conflicting user data led her to a closer examination which uncovered how two separate manuscripts had bonded together, presumably while lying adjacent to each other in one of the trash heaps outside Oxyrhynchus.

During June and July of 2015, Sellew spent two weeks in England studying some of the Oxyrhynchus papyri in person at the British Library in London and the Sackler Library at Oxford University (but no unpublished texts were permitted her to be examined). She consulted with our UK partners Obbink and Brusuelas on various matters related to any potential future collaborations with the Oxyrhynchus Papyrology Project, and closely studied an early Christian manuscript already in print that preserves an otherwise unknown non-canonical gospel, one of her main areas of research (see her recent publications in Appendix 2 below).

Sellew and her students continued to work with published and unpublished Coptic and Greek literary and documentary texts throughout the academic year 2015-2016, especially those related to early Christianity in Egypt, and mostly on papyrus. One venue for this work was Sellew's year-long class on Coptic language and literature, where they studied the *Apocryphal Acts of Paul and Thekla*, as it survives in the Achmimic dialect of Coptic, and the *Gospel of Thomas*, surviving fully in a single Coptic manuscript in the Sahidic dialect (with Lycopolitan phonological features), along with three fragmentary papyri in Greek found at Oxyrhynchus.

In the fall of 2015, Sellew taught a graduate seminar on *The Book in Roman Egypt*, which connected directly with this ongoing collaborative research project. This seminar generated more research opportunities for students, three of whom were also in the Coptic class, and two of whom received summer funding to produce publishable versions of their papers for the seminar. M.A. and Ph.D. students explored the historical and cultural contexts for literacy, reading practices, and emerging canon formation in Roman Egypt (ca. 30 BCE to 640 CE). They also learned the basic tools of ancient manuscript studies, including the principles of paleography, papyrology, and codicology. Each student made reports on specific

papyri and wrote substantial research papers on topics related to Greek or Coptic papyrology. Members of the seminar included Alyssa Cady, the M.A student hired the previous summer as a research assistant on the Ancient Lives project, as well as several individuals who wish to pursue further studies in this aspect of the field. Anthony Thomas worked on the *Cologne Mani Codex*, a miniature papyrus book from 5<sup>th</sup> century Egypt, and drew on that work for his paper at the Byzantine Studies Conference in October 2017. Jeff Cross re-investigated an odd Greek papyrus (Papyrus Amherst Gr. i.3), housed in the Morgan Library and Museum in New York that he suggested was used as an amulet.

With additional funding from the CNES department, Cross attended workshops on Demotic papyrology in Leipzig and Greek palaeography at Lincoln College, Oxford, in the summer of 2016, and while visiting the Bodleian Library at Oxford he studied the correspondence of Arthur Hunt, who had excavated and first published the Amherst papyrus, and later visited the Morgan Library for direct study of the manuscript. This led to his prize-winning essay on “Amuletic Enigmas.”

In spring 2016 undergraduate major Betsy Bixby, quite proficient in Greek, joined the project with funding from the University’s Undergraduate Research Opportunity Program and worked with the team in testing our prototype replacement of the user interface and our initial Coptic keyboard. Another important student worker on the project has been Genevieve (Gennie) Kieffer, a major in Classical Civilization and one of Sellew’s Coptic students who joined the team in Spring 2016 under the rubric of a Directed Study project. After her graduation that spring, Gennie started a master’s program in Digital Information Science through a distance-learning program through the library school at the University of Wisconsin at Milwaukee.

Gennie played a key role in the preparation of our newly designed website over the final six months leading up to our relaunch. This year she has been working as part of a research internship, applying her skills in digital information management and communication to excellent effect. She tested the site for bugs and glitches, employing a good eye for subtle problematic issues. She also wrote the new Tutorial and Help texts, helped with construction of the FAQ and other content for the site, and intends to write posts for the site’s Blog going forward. As an information technology specialist, usability and accessibility were among the most important aspects of the website for her, thus her work highlighted outcomes related to users being satisfied with the interface and easily able to navigate each function.

An unanticipated interruption to our progress arose in Spring 2016 from the decision on the part of our hosts at the Zooniverse citizen science consortium to update the web platform supporting crowd-sourced research completely on a new model (called Panoptes), which meant that we had to jettison our initial work already completed in conjunction with our UK partners on constructing the Coptic keyboard and analytical database. (This crisis is discussed more thoroughly under section 4 [Challenges faced] below.)

Initially, our attempted solution was to have our consulting partner John Wallin of Middle Tennessee State University supervise coding work by his former student Alex Williams to this end; Williams, who completed his M.S. under Wallin's supervision in May 2015, with a thesis on the Ancient Lives computer software, began a Ph.D. program in Waterloo, Canada, in September 2015, and worked as time was available through January 2016 to try to adapt the Ancient Lives architecture and user interface to the new Panoptes web system. The new architecture was not yet put into place by Zooniverse by the close of January 2016, however, and while awaiting its introduction the Ancient Lives program went dark in March 2016.

Through the intervention of co-PI Lucy Fortson, we decided to redirect the unspent funds for the salary of our postdoctoral fellow, who would have little to do while the site was dark, to pay for developer time once Williams was no longer involved. Salary monies initially designated for a post-doctoral fellow to replace the departed Marthot-Santaniello were retained, and then redirected to hire a more experienced developer dedicated to rebuilding the Ancient Lives interface and its backend in order to align it with the Panoptes system by then already launched by Zooniverse. At Fortson's suggestion we sought two no-cost extensions for our project's timeline to allow us to bring the Ancient Lives 2.0 web interface to completion and launch. In 2017, after an infusion of other funds located by Fortson and her colleagues, a highly skilled developer already in place in Minnesota as part of the Zooniverse team, Andrea Simenstad, was brought on board. From the summer of 2017 through the spring of 2018, Simenstad worked successfully to overhaul the original interface and prepare it first for beta testing and then for relaunch by the close of April 2018.

This is a summary of Simenstad's work on the project: The first step in her process was evaluating previous iterations of the project and code bases. She then worked to assess whether to create a custom built project, Project Builder project, or continue with the current codebase. After determining to build a custom built project, she started working on and learning new aspects of the technology stack for Zooniverse custom frontends. With PI Sellevay on sabbatical last year, Simenstad convened weekly meetings of the team to confer on the work in progress. She also created some early prototypes of the keyboard in Codepen for the research team, discarding the initial efforts by Smith and Williams as unsuited to the Panoptes architecture.

The team decided to unite the Greek and Coptic characters on a single keyboard, with the six special Coptic characters along the top row. To the inexperienced user, Roman-period manuscripts in Greek and Coptic look quite similar due to the use of the Greek script even for texts in the Coptic language. Simenstad instructed research team members in the use of the Project Builder tool and other devices to enter new or updated information directly on the site, such as refreshing the suggestions offered in the Help or Talk sections linked to the transcription page.

Simenstad made substantial improvements to the Ancient Lives user interface, powered by the more supple Panoptes architecture now in use by Zooniverse. These advances include a much more pleasing appearance of the screen, in terms of its

colors, layout, and legibility; making tabs and buttons for such functions as accessing the FAQ or Field Guide or Talk features more visible and easier to use; introducing a mobile keyboard, partly transparent, that allows users greater flexibility in working with papyrus images; adding a feature that allows users to save their work on specific images, even if they have submitted the work for the consensus algorithm pipeline; and more less obvious improvements to the interface that smooth out some of the imperfections of our AL 1.0 system.

The newly designed user interface was completed in April 2018 in time for our relaunch on April 26<sup>th</sup>; a full public launch is planned by Zooniverse for the first week of May 2018. The site may be accessed at [ancientlives.org](http://ancientlives.org).

### **3. Patterns of collaboration**

Collaboration has been a hallmark of Ancient Lives in both its phases as well as our plans for the future. Minnesota got involved in Zooniverse on the arrival in to the School of Physics and Astronomy of Lucy Fortson from the Adler Planetarium in Chicago, where she had been a founding figure of the Zooniverse team with the Citizen Science Alliance. Fortson approached Nita Krevans and Melissa Harl Sellew in the Department of Classical and Near Eastern Studies in the spring of 2011 about the possibilities of a cross-disciplinary collaboration on crowd-sourcing the digitized Oxyrhynchus Papyri, and after discussion we wrote a successful grant application for a two-year Minnesota Futures award of circa \$250,000 that enabled us to serve as a major partner in the launch and development of Ancient lives (Phase One) under the guidance of Chris Lintott of Oxford and his Zooniverse team there.

Our team experienced two years of close and successful collaboration amongst the scholars involved: Lucy Fortson and Nita Krevans and Melissa Harl Sellew, joined by Anne-Françoise Lamblin of the Minnesota Supercomputer Institute. Our specialist consultant John Wallin of Middle Tennessee State University, already an established collaborator within the Zooniverse network, added computational science expertise in developing our consensus algorithms and monitoring the data outputs. Crucial to this mix was our transoceanic collaboration with Dr. Dirk Obbink, Lecturer in Greek at the University of Oxford and Director of the Oxyrhynchus Papyri Project at the Sackler Library, along with his research associate in Digital Philology, Dr. James Brusuelas. Conversations between and amongst us over these two years had revealed both the substantial differences in how research questions are posed and addressed in our various fields of study, but also led to quite fruitful collaborations.

Our team met quite regularly, most often on a weekly basis, starting in Spring 2014 and continuing throughout Phase Two, with some people gathering in a physical location on campus, and others joining remotely by Skype. There was also regular and frequent communication amongst the various members of our disciplinary subgroups, along with their research associates and students. This consistent schedule allowed us to keep an eye on progress of the widely different aspects of our work, involving as it did development of computer code for complex tasks, on

one end of the spectrum, to deciphering and interpreting fragmentary Greek and Coptic texts in literary and historical terms at the other end of this notional pole.

In addition to the collaborations within and amongst our team, we also met with the leadership and technical experts of the Zooniverse network when visiting the UK or on their (nearly) annual visits to Minneapolis. This brought us on the Classics side up-to-date about plans for technical improvements (such as a wholesale redesign of the backend computing architecture) and those on the Computing side informed about our progress or roadblocks.

Another key collaborative goal has been to share our work with colleagues in related fields, often by speaking at conferences or the like. Highlights include:

a. Our initial efforts for collaboration with colleagues in Classics and Papyrology at Duke University were mentioned above. This took place by email and in a full-day Skype meeting of all our partners in June 2014, with contributions from Trevor Wennblom (informatics), John Wallin, Professor Josh Sosin of the Duke Digital Collaborative, which is associated with the key web resource Papyri.info, and two computing experts from the Zooniverse platform. We expect there to be new avenues opening up here now that our platform has been fully redesigned and is in public operation.

b. PI Melissa Harl Sellev presented a paper in the Digital Humanities session of the annual meeting of the *Society of Biblical Literature* in San Diego in November 2014 with the title *Resurrecting Early Christian Lives: Digging in Papyri in a Digital Age*, announcing the new work of the Ancient Lives research team and inviting participation in our project by interested colleagues in Digital Humanities, Coptic literature, and Biblical Studies.

c. Sellev and her colleague in Classics, co-PI Nita Krevans, attended the meeting of the *American Society of Papyrologists* that was held in conjunction with the *Society for Classical Studies* in New Orleans in January 2015. There they communicated the goals of the project and solicited continued participation by interested colleagues and their students in going on the *Ancient Lives* site to transcribe papyri uploaded there.

d. Sellev gave a paper in March 2015 at Georgetown University in Washington, D.C. for the conference *Digital Coptic 2: A Symposium and Workshop on Digital Humanities and Coptic Studies*, organized by Professor Caroline Schroeder of the University of the Pacific.

Schroeder and her team have been working on other aspects of Coptic digital humanities, especially syntactic coding of published literary texts, funded under a different NEH grant. Schroeder's team (SCRIPTORIUM) has been doing work of interest to our group, but on a different sort of research – tagging published texts, not transcribing unpublished fragments. At this symposium, Sellev met with

colleagues (both established and emerging) from the U.S., Germany, Egypt, The Netherlands, and Japan, and made useful connections for future collaborations. One of these might involve including in our next phase the crowd-sourcing of tiny manuscript fragments from the White Monastery in Egypt written by the Coptic author and theologian Shenoute that were located recently by an archaeological team from Yale University. The goal there would be developing machine-run handwriting recognition competencies.

e. When members of our research team Sellew, Krevans, Marthot-Santaniello, and grad student Alyssa Cady presented our project at the *North American Papyrology Seminar*, hosted by the University of Michigan in Ann Arbor we also explored expanding our subject database to include the many Coptic ostraca held in the Kelsey Museum there. Its director, Professor Terry Wilfong, expressed willingness to have digitized images of the ostraca added as a distinct dataset in the newly launched Ancient Lives 2.0.

f. During June and July of 2015, Sellew spent two weeks in England to study *Oxyrhynchus papyri* in person at the British Library in London and the Sackler Library in Oxford University. She consulted with our UK partners Obbink and Brusuelas on various matters related to any potential future collaborations with the *Oxyrhynchus Papyrology Project*.

g. Sellew attended a Coptic conference at Harvard University in September 2015 (*Nag Hammadi Consortium*), hosted by Professor Karen L. King, where she shared aspects of our progress with colleagues from across North America and several European countries, including Russia, Finland, Norway, France, and Germany.

h. Postdoctoral fellow Isabelle Marthot-Santaniello, even after her move to a postdoctoral research position in Ancient History at the University of Basel, made a presentation on our project at a Digital Humanities conference that focused on Coptic at the University of Leipzig (Germany) in November 2015, where she also explored potential partnerships for us with the Coptic palaeographer Frank Feder of Göttingen, the Coptologist Professor Sebastian Richter (Berlin), and the computer scientist Marc-Jan Nederhof (St. Andrews, Scotland), who is working on digital transcriptions of hieroglyphs, both on papyrus and on wooden and stone stelae.

i. In November 2016, Sellew presented a paper on *Coptic Hymns* at the annual meeting of the *Society of Biblical Literature* in Atlanta, using some of the data that has emerged from our research. In December 2016, she gave a public lecture on the *Resurrecting Early Christian Lives* project, sponsored by the Archaeological Institute of America and hosted by Macalester College and its Classics Department.

j. Co-PI Nita Krevans attended the *Digging into Data* general conference in Glasgow in January 2017 to report on our work, in conjunction with James Brusuelas of the *Oxyrhynchus Papyri Project* at Oxford, who was representing our UK partners.

#### 4. Challenges we faced

When our diverse team discussed proposing this research project for two years of funding from the NEH (USA) and AHRC (UK), the teams in each country were meant to construct a research question to be addressed by the crowd-sourced data. We at Minnesota settled on the topic of *Resurrecting Early Christian Lives* with Sellew as PI, as a means by which to search and analyze fragmentary documents that we hoped would shed light on the lives of early Christians in Egypt. To further that goal we proposed adding work on the prevalent indigenous language of Egypt through the first millennium, namely Coptic. When Brusuelas' proposal for the UK team to study tax receipts for a deeper understanding of economic trends in Byzantine Egypt was not approved at the last minute by his supervisors, for reasons of time and effort management at their location, apparently, this put all the eggs in our research basket, so to speak. But it was something of a warning sign that our cooperation with our UK partners would have some unexpected limits.

A more substantial challenge to our proceeding with our work as planned was the decision on the part of our hosts at the Zooniverse citizen science consortium to update the web platform supporting crowd-sourced research completely on a new model (called Panoptes), which meant that we had to jettison our initial work already completed in conjunction with our UK partners on constructing the Coptic keyboard and analytical database.

The main challenge facing our team was managing the delays incurred by the need to redesign the Ancient Lives interface. The original interface on Zooniverse was built on the first version of the technology "stack" - the web-based technology required for Zooniverse to serve images and record the interactions of the public with those images. The original effort for Zooniverse proper was "just" to provide a keyboard for Coptic-related texts as an add-on to the original Ancient Lives interface. However, due to several issues, including those related to security updates, the Zooniverse tech-stack was no longer able to support the original Ancient Lives interface and was undergoing a complete overhaul by the time the work funded by the Digging into Data grant was underway. The team responded by allocating a matching effort from both Oxford and Middle Tennessee State for an interface redesign.

Progress was made steadily during 2015. However, unfortunately, it turned out that the amount of effort for the redesign to be completed was beyond the resources available. By our original end date in late Summer 2016, we were left with a 95% developed interface but with some key unresolved issues that prevented us from relaunching. At that point, the University of Minnesota team, led by co-PI Lucy Fortson, our liaison with the Zooniverse network, requested a no-cost extension and began to look for matching funds to finish the rebuild; funds were obtained and the current UMN Zooniverse web developer identified by February 2017 (Andrea Simenstad), after which the site rebuild got underway again. The site has just finished its beta phase and was put into limited relaunch on April 26, 2018, with a

fully public launch the subsequent week. As the Zooniverse liaison for the entire project, Professor Fortson keenly felt responsibility for the delivery of the interface rebuild and thus it was she who drove this process to find our path forward.

We on the Minnesota research team in Classics and early Christian studies were frustrated by an unanticipated refusal by the Egypt Exploration Society to allow us to proceed with the publication of the documents we discovered, curated, and identified through the consensus reconstruction process. The Society and its officers are legal owners of the papyri, apparently protected by Victorian-age British laws, operating it seems under rules in effect at the time period of their excavation and shipment to England, which permit them to withhold access from anyone they choose. They never addressed us directly; instead these refusals came to us via our partners at Oxford. Our being excluded came as something of a shock, to put it mildly, since the understanding we had with our UK partners in writing the grant proposal was that we would of course be given such permission as part of a major international research collaboration. We also believe we have an obligation under the terms of our grant and the contemporary ethics of literary, archaeological, and historical scholarship worldwide to work in a free, open-source environment.

Repeated attempts on our part to undo this blockage were all unsuccessful, even when we sought to have our appeals seconded by the papyrological partners in Oxford, Dirk Obbink — Director of the Oxyrhynchus Papyri Project! — and James Brusuelas, both of whom of course were working under the supervision and authority of the Society and hence told us that they could not override the Society's policies. We were informed that all of the interesting documents that Isabelle Marthot-Santaniello discovered, such as the butcher's bill for Easter pork, or the fragment of the *Apophthegmata Patrum* that might well solve pressing issues of splits in its manuscript tradition, were off-limits to us, since in every case they were said to have been "reserved" for members of the Society itself, or for their own potential and unnamed students to edit and publish at some unspecified future date, sometimes having been first "held" decades ago. This lack of cooperation persisted despite the acknowledged facts of the expertise of our academic team, including three members (Sellew, Smith, and Marthot-Santaniello) who have each published and continue to publish critical editions and analyses of similar texts.

The odd exception to this exclusionary policy was that students who had been trained (usually for only one week) by our papyrological colleagues at the Sackler could and would be assigned papyri to edit for publication; consider for example Sellew's student Jessica Shao being assigned the only known 1<sup>st</sup> *Timothy* papyrus for publication in the EES's official series. But when Sellew herself visited Oxford in 2015, having written in advance to request access to unpublished papyri directly related to her primary research interest (apocryphal Christian literature in Coptic and Greek), she was directly refused permission, a refusal said to be at the behest of the Society, despite her status as PI for the US arm of this collaborative project! Instead, she was allowed only brief, supervised examination of two manuscripts already prepared for publication, including that *Timothy* papyrus edited by her own



student, who was largely trained by her in Minnesota, apart from that one week in Oxford. Our response (not a solution, of course) to this poor treatment was to decline to submit new grant proposals in partnership with institutions or individuals who clearly did not see us as true collaborators, apart from the funding we could provide them, or who declined to operate according to contemporary ethical standards of scholarly cooperation.

Given this roadblock in making any scholarly use of her discoveries on our project, we of course supported the departure of Isabelle Marthot-Santaniello to take up a new position as postdoctoral researcher (*Assistentin*) in the Department of Ancient History at Basel, in the fall of 2015, even though this was at least half a year before she had been scheduled to conclude her work. Already in view was the shutting down of Ancient Lives Phase One in the spring of 2016, while we awaited the redesign of the Zooniverse backend architecture (Panoptes). Our response to these delays has been discussed above.

In the winter of 2015-2016, the decision was made to completely revamp the architecture supporting the backend of the Zooniverse crowd-sourcing platform. This meant that Ancient lives went dark in March 2016, and though we were able to continue working with the data collected to that point, no new transcriptions were entering the pipeline to form new consensus reconstructions for our analysis. Nor had the Coptic keyboard been produced by our UK partners as originally agreed.

With Marthot-Santaniello having left the team the previous fall to take up her position in Switzerland, we had some funds left over that had been slated to pay her salary for the rest of her term. Co-PI Lucy Fortson, a key member of the Zooniverse team since her involvement in its initial Galaxy Zoo project, proposed that we take those funds and, with additional monies contributed by Zooniverse itself, hire a new developer (Andrea Simenstad) with the positive outcomes as described above.

## **5. Potential applications**

Our team believes that there are several useful applications of our tools in other research contexts. Crowd-sourcing masses of unpublished, handwritten texts can greatly speed up the process of transcription, reconstruction, editing, and eventual publication.

In effect our program has been refining the software to recognize hand written alphabetic characters with no new human interventions once a high level of accuracy has been achieved. In the Greek papyri fragments from Oxyrhynchus, we found that given 10 characters in an uninterrupted string, we could identify any published source text with a 90% accuracy or better; with fifteen to twenty characters – even with gaps – that ratio approached 100% (a level that will not be reached given human error in the processes involved).

The next technical development to build on that record would be a robust program of scribal handwriting recognition, so that even tiny fragments of mutilated manuscripts (not just ancient papyri, but medieval texts as well) might be reunited once the same hand is observed across bits of the original manuscript now scattered in different collections.

One example is the important corpus of the writings of Apa Shenoute, monastic leader in 5<sup>th</sup>-century Egypt who became the country's best-known Coptic author and theologian. His extensive library of sermons, letters, and treatises, kept for many centuries undisturbed in the White Monastery that he built up along the Nile River near modern Sohag, was ransacked starting in the early modern period by Western visitors, scholars, and churchmen, who took the books back to stock their own libraries. In this way Shenoute's works were divided up, often secondarily torn up for sale to more purchasers, so that a few pages of one and the same book are now in Naples, a few more in Vienna, still more in Paris, New York, or London: and yet the smaller bits have fallen away and can no longer be reattached to their original books.

Recent fieldwork at the White Monastery by scholars at Yale University discovered the original storeroom of those books, and, amazingly, on and just under its floor were found preserved many tiny scraps that had been torn or fallen off the edges of the books' pages. It seems as though a developed handwriting recognition program could rather rapidly assign each scrap of writing to its particular scribe, thus leading to many restorations of the page edges to their rightful place.

We have discussed mounting other databases on our website and running the data through our transcription pipeline with several other teams of scholars. Examples, which represent varying levels of interest or commitment on the part of the scholars involved, include:

- a. digitized photos of Greek and Hebrew biblical and parabiblical texts conserved at the University of Pennsylvania (contact: Robert A. Kraft);
- b. papyri from the Arsinoite nome of Byantine-era Egypt that are held in Basel and Paris (contacts: Anne Boud'hors, Isabelle Marthot-Santaniello, Sabine Huebner);
- c. many ostraca (potsherds) with Coptic texts (letters, tax records, receipts, etc.) excavated in Egypt now held at the Kelsey Museum at the University of Michigan (contacts: Terry Wilfong and Ellen Muehlenberg);
- d. digital transcriptions of Egyptian hieroglyphs written on papyrus, wood and stone, being studied by a team at the University of St. Andrews (Scotland) (contact: Mac-Jan Nederhof);
- e. a variety of Syriac manuscripts of interest to scholars at Vanderbilt University (contact: David Michelsen);

and, perhaps most likely to proceed in the near future,

f. a large corpus of Biblical manuscripts in Coptic being collected by the Akademie der Wissenschaften zu Berlin as part of their twenty-year ERC funded project to publish the first complete edition of the Coptic Old Testament (contact: Frank Feder).

## **Appendix 1: Personnel on the Grant, 2014-2018**

### *Principal Investigator*

Melissa Harl Sellew (Th.D. Harvard), Associate Professor of Classical and Near Eastern Studies, University of Minnesota [former name: Philip H. Sellew].

### *Principal Investigator for the parallel AHRC (UK) grant*

Dirk Obbink (Ph.D. Stanford), Lecturer in Papyrology and Greek Literature, Oxford University, Fellow and Tutor of Christ Church, and [now former] Director of the Oxyrhynchus Papyri Project.

### *Co-Principal Investigators at the University of Minnesota*

Nita Krevans (Ph.D. Princeton), Associate Professor and Chair of Classical and Near Eastern Studies.

Lucy Fortson (Ph.D. UCLA), Professor of Physics and Astronomy, and our liaison with Zooniverse.

Anne-Françoise Lamblin (Ph.D. University of Minnesota), Program Director for Research Informatics, Minnesota Supercomputing Institute; now Research Manager, King Abdullah University of Science and Technology, Saudi Arabia.

### *Consultants*

Dr. John Wallin (Ph.D. Iowa State University), Professor of Physics and Astronomy and Director of Computational Science, Middle Tennessee State University.

Dr. Joshua Baller, Research Associate, Minnesota Supercomputing Institute.

### *Postdoctoral Fellows, 2011-2015*

Isabelle Marthot-Santaniello (Ph.D. Paris), now *Assistentin* in Ancient History, University of Basel, Switzerland.

Marco Perale (Ph.D. Venice), now Lecturer in Greek at the University of Liverpool.

Geoffrey Smith (Ph.D. Princeton), now Assistant Professor of Greek and Religious Studies, University of Texas at Austin.

### *Researchers*

James Brusuelas (Ph.D. University of California, Davis), Researcher in Papyrology and Digital Philology, Faculty of Classics, Oxford University.

Andrea Simenstad, Zooniverse Software Developer, University of Minnesota.

Trevor Wennblom, Senior Software Developer, Minnesota Supercomputing Institute, University of Minnesota (2014-2015).

Alex Williams, M.S. student in Computer Science, Middle Tennessee State University; now Ph.D. student in Computation Science, University of Waterloo (Canada).

*Students in Classical and Near Eastern Studies, University of Minnesota*

Anna Everett Beek, Ph.D. candidate in Classics; now Adjunct Professor in History, University of Memphis.

Sam Berks-Hinkley, Ph.D. student in Classics [beginning in June 2018].

Betsy Bixby, B.A. major in Classical Civilization.

Alyssa Cady, M.A. student in Religions in Antiquity; now a Ph.D. student in Religions of the Ancient World, Princeton University.

Theresa Chresand, B.A. major in Classics (Greek); now a Ph.D. student in Classics, University of Cambridge (UK).

Kristofer Coffman, Ph.D. student in Religions in Antiquity [beginning in June 2018].

Jeff Cross, M.A. student in Classics; now a Ph.D. student in Religions in Antiquity.

Rachael Cullick, Ph.D. student in Classics; now Visiting Assistant Professor of Classics, Oklahoma State University) (Phase One).

James Kepler, B.A. student.

Genevieve Kieffer, B.A. major in Classical Civilization; now an M.L.S. student in Digital Information Sciences, University of Wisconsin – Milwaukee.

Jennifer Phillips, B.A. major in Classics (Greek).

Alyssa Ramsden, B.A. major in Classical Civilization.

Ryan Seaburg, Ph.D. student in Classics (Phase One).

Jessica Shao, Ph.D. student in Greek.

Kalyssa Tatroe, B.A. major in Classical Civilization.

Anthony Thomas, Ph.D. student in Classics.

## Appendix 2: Publications and Selected Presentations Arising from the Grant

- Jeffrey M. Cross, "Amuletic Enigmas: Identifying P. Amh. Gr. 1.3." M.A. paper, University of Minnesota, May 2016. Winner of the Jeremias Prize of the Canadian Society of Biblical Studies, 2017.
- Isabelle Marthot-Santaniello, "The Treasures of the Dioscorus Archive: How a coherent group of papyri sheds new light on the literature and history of Byzantine Egypt." Lecture at the University of Minnesota, March 2015.
- Isabelle Marthot-Santaniello, "Manuscripts, from Fragments to Books - From Identification to Interpretation." Presentation on *Ancient Lives* to ManuSciences'15, Frauenchiemsee (Germany), September 2015.
- Isabelle Marthot-Santaniello, "Crowd-Sourcing Papyri Fragments: The *Ancient Lives* Project." Presented at the conference on Altertumswissenschaften in a Digital Age: Egyptology, Papyrology and Beyond, Leipzig, November 2015. url: <http://ul.qucosa.de/api/qucosa%3A14648/attachment/ATT-8/>
- Isabelle Marthot-Santaniello, "Coptic texts in the Basel Papyrus Project." Paper presented at the 11<sup>th</sup> Conference of the International Association of Coptic Studies, Claremont, Calif., July 2016.
- Isabelle Marthot-Santaniello, "Noms de personne ou noms de lieu? La délicate question des « toponymes discriminants » à la lumière des papyrus d'Aphroditô (VIe s. -VIIIe s.)." Paper presented at the conference *Living the End of Antiquity – Individual Histories from Byzantine to Islamic Egypt*, University of Basel, May 2017.
- Melissa Harl Sellw, "Resurrecting Early Christian Lives: Digging in Papyri in a Digital Age." Paper read in the Digital Humanities session at the Annual Meeting of the Society of Biblical Literature in San Diego, November 2014.
- Melissa Harl Sellw, "Tracking User Data, Sequencing Characters, and Building Consensus Reconstructions." Paper read at Digital Coptic 2: A Symposium and Workshop on Digital Humanities and Coptic Studies, Georgetown University, March 2015.
- Melissa Harl Sellw, "New Results from Crowd-Sourcing Coptic Papyri." Paper presented at the Coptic Digital Humanities workshop, 11<sup>th</sup> Conference of the International Association of Coptic Studies, Claremont, Calif., July 2016.
- Melissa Harl Sellw, "Coptic Hymns: Evidence from the Papyri." Paper read in the Prayer in Antiquity section at the Annual Meeting of the Society of Biblical Literature, San Antonio, November 2016.

Melissa Harl Sellew, "Resurrecting Early Christian Lives from an Ancient Egyptian Trash Heap." Public lecture sponsored by the Archaeological Institute of America, Minnesota Chapter, Macalester College, December 2016.

Melissa Harl Sellew, "James and the Rejection of Apostolic Authority in the *Gospel of Thomas*." Pp. 193-207 in *Delightful Acts: New Essays on Canonical and Non-Canonical Acts*. Edited by Harold W. Attridge, Dennis R. MacDonald, and Clare K. Rothschild. WUNT, 391. Tübingen: Mohr Siebeck, 2017.

Melissa Harl Sellew, "History of the Book as Material Object: The *Gospel of Thomas*." Boldt Lecture in the Humanities, St. Olaf College, March 2017.

Melissa Harl Sellew, "Reading Jesus in the Desert: The *Gospel of Thomas* Meets the *Apophthegmata Patrum*." Chapter Three in *The Nag Hammadi Library and Late Antique Egypt*. Edited by Hugo Lundhaug and Lance Jannot. STAC 110. Tübingen: Mohr Siebeck, 2018.

Melissa Harl Sellew and Jessica Shao, Poster presentation on *Resurrecting Early Christian Lives* at the Graduate School Research Fair, University of Minnesota, March 2014.

Melissa Harl Sellew, Nita Krevans, Isabelle Marthot-Santaniello, and Alyssa Cady, "Crowd-Sourced Transcriptions and the Identification of Unpublished Greek Texts." 60-minute panel presentation at the North American Papyrological Seminar, University of Michigan, May 2015.

Jessica Shao, "Family 1 in Mark: New Evidence on the Stemma of the Venice Group." Presented in the Textual Criticism Section at the Annual Meeting of the Society of Biblical Literature, Atlanta, November 2015.

Jessica Shao, "1 Timothy 3:13–4:8." Critical edition in *The Oxyrhynchus Papyri*, vol. LXXXI. London: Egypt Exploration Society, 2016.

Geoffrey Smith, "A Manichaean Hymn at Oxyrhynchus: A Reevaluation of P. Oxy. 2074," *Journal of Early Christian Studies* 24.1 (2016), 81-97.

Geoffrey Smith, "Anti-Origenist Redaction in the Fragments of the *Gospel of Truth* (NHC XII,2 ): Theological Controversy and the Transmission of Early Christian Literature." *Harvard Theological Review* 110 (2017), 46-74,

Geoffrey Smith, "P. Oxy. 5258: Ephesians 3:21-4:2." Critical edition in *The Oxyrhynchus Papyri*, Vol. LXXXI. London: Egypt Exploration Society, 2016.

Geoffrey Smith, "The Willoughby Papyrus: A New Fragment of John 1:49–2:1 and an Unidentified Christian Text." Paper presented at the Annual Meeting of the Society of Biblical Literature, Atlanta, 2015. Article forthcoming in *JBL*.

Anthony Thomas, "Writing Resolving Tension in the *Cologne Mani Codex*." Paper presented to the Department of Classical Studies, University of Minnesota, December 2016.

Anthony Thomas, "Sailing Along: Crescent Moons in Manichean Mythology and Art." Paper presented at the Biennial Byzantine Studies Conference, Minneapolis, October 2017.

Alex C. Williams, "Computational Accelerated Papyrology." M.S. thesis in Computer Science, Middle Tennessee State University, May 2015.

Alex C. Williams, Hyrum Carroll, John Wallin, James Brusuelas, Lucy Fortson, Anne-Françoise Lamblin, and Haoyu Yu. "Identification of Ancient Greek Papyrus Fragments Using Genetic Sequence Alignment Algorithms." *IEEE 10th International Conference on e-Science* (October 2014), Vol. 2, pp. 5-10.

Alex C. Williams, John Wallin, Haoyu Yu, Marco Perale, Hyrum Carroll, Anne-Françoise Lamblin, Lucy Fortson, Dirk Obbink, Chris Lintott, and James Brusuelas, "A Computational Pipeline for Crowd-sourced Transcriptions of Ancient Greek Papyrus Fragments." *Proceedings - 2014 IEEE International Conference on Big Data, IEEE Big Data 2014*, pp. 100-105.



### **Appendix 3: Funding leveraged by the grant**

PI Melissa Harl Sellew received University of Minnesota funding (Grant-in-Aid-of-Research) to travel to Dumbarton Oaks in Washington, D.C. in March 20-14, then Vienna in Summer 2014 and to London and Oxford in Summer 2015 to consult Greek and Coptic manuscripts like those being analyzed through our program.

Sellew received funding from the SCRIPTORIUM to present her work on the project at the 2<sup>nd</sup> Digital Humanities and Coptic Workshop in Washington, D.C., Spring 2015.

Co-PI Nita Krevans received a series of grants from the Consortium on the Study of the Premodern World (University of Minnesota) to present workshops on ancient book production, reading practices, writing systems and the like, where students were exposed to many of the data surfaced by our Ancient Lives work.

#### Student research assistants hired through the NEH grant:

Anna Everett Beek, Ph.D. student in Classics: 2015.

Theresa Chresand, B.A. student in Greek and Latin: Spring 2014.

Jessica Shao, Ph.D. student in Greek: 2014-2015.

#### Students funded by the Undergraduate Research Opportunity Program:

Betsy Bixby, B.A. student in Greek: Spring 2016.

Alyssa Ramsden, B.A. student in Classical Civilization: 2014-2015.

Kalyssa Tatroe, B.A. student in Classical Civilization: 2014-2015.

#### Students funded by the Graduate Research Partnership Program:

Sam Berks-Hinkley, Ph.D. student in Classics: Summer 2018.

Alyssa Cady, M.A. student in Religions in Antiquity: Summer 2015.

Kristofer Coffman, Ph.D. student in Religions in Antiquity: Summer 2018.

Jeff Cross, M.A. student in Religions in Antiquity: Summer 2016.

Anthony Thomas, Ph.D. student in Classics: Summer 2016.

#### Funding through the Department of Classical and Near Eastern Studies:

James Kepler, B.A. student: 2016-2017 (Chair's research fund).

Jennifer Phillips, B.A. student in Classics: Spring 2018 (Chair's research fund).

Jessica Shao and Jeff Cross received departmental graduate program funding to attend the workshops on papyrology and paleography in Oxford and Leipzig. Cross also received department support to visit the Morgan Library and Museum in New York City for his project on the P. Amherst papyrus amulet..

